

Section 1.0 Alosines (Shad & River Herring)

Introduction

American shad were historically one of the most valuable fish within the Chesapeake Bay, and throughout the East Coast. In 1896, at the peak of the American shad harvest, nearly 18 million pounds were harvested. By the 1900s, overharvest and loss of habitat contributed to a decrease in alosid abundance. The construction of dams throughout the watershed and four major hydroelectric dams on the Susquehanna River in the early 1900s eliminated access to important spawning habitat. Alosine habitat and abundance continued to decrease as the human population and river impoundments increased (Fig 1.1) (St. Pierre 2004). Based on landings data and the estimated abundance of shad, a sustainable fishery occurred from 1950 to 1970, when the commercial landings ranged from 2.2 to 5.6 million pounds. In the late 1970's, commercial landings of shad dropped to less than 50,000 pounds. Since 1980 there has been a moratorium on harvesting American shad from Maryland waters of the Chesapeake Bay. The Potomac River Fisheries Commission implemented a moratorium in 1982 and Virginia followed in 1994. However, an ocean-intercept fishery was open and Maryland and Virginia harvested American shad from the Atlantic Ocean. The Atlantic coast fishery (which includes all the coastal states) was closed as of January 1, 2005.

There are a variety of factors responsible for the decreased abundance of alosids. Habitat degradation seems to be one of the major contributors to reduced herring and shad in the Chesapeake Bay. As part of the Chesapeake Bay Program's commitment to protect and conserve natural resources, a fishery management plan was developed for shad and herring and a number of restoration efforts were initiated.

Chesapeake Bay FMP

In 1989 a Chesapeake Bay Alosid Fishery Management Plan (FMP) was developed for the commercially important alosines historically harvested within the Chesapeake Bay. Alosines include American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), and alewife herring (*A. pseudoharengus*). Blueback and alewife herring are collectively known as "river herring" because they are nearly identical and difficult to tell apart. Throughout the historical fisheries accounts and data sets these two species have been reported under the collective grouping as "river herring." There has been more effort to separate the landings according to each species in recent years.

The 1989 Chesapeake Bay Alosid FMP identified the following problem areas for alosids: continued declining abundance; the potential for overfishing; research and monitoring efforts; and habitat loss and degradation. Historic shad abundance has been difficult to estimate because of inconsistencies in landings data. One of the strategies defined in the Alosid FMP was the criterion for reopening a shad fishery. The plan also described a strategy for working with the Fish Passage workgroup to open habitat and/or provide fish passage. Shad restocking efforts was another component of the restoration

objectives. Guidelines were developed to reduce herring fishing mortality and continue the moratorium on shad harvest.

In 1998 the FMP was amended (Amendment #1) to revise the target for reopening a fishery and to include tributary-specific targets once they were developed. The amendment recognized the need for continued restocking and removal of fish blockages so fish can access historical spawning grounds. As part of the Chesapeake 2000 Agreement, several fish passage commitments were developed and are important for anadromous fish, especially alosids. The commitments are: 1) identify the final initiatives necessary to achieve the existing goal of restoring fish passage to more than 1,357 miles of currently blocked river habitat and establish a monitoring program to assess outcomes; 2) set a new goal with implementation schedules for additional migratory and resident fish passages that addresses the removal of physical and chemical blockages; 3) determine tributary-specific target population sizes based upon projected fish passage, and current and projected habitat available, and provide recommendations to achieve those targets; and, 4) revise fish management plans to include strategies to achieve target population sizes of tributary-specific migratory fish. The fish passage goal was met at the end of 2004 with approximately 1,400 miles of habitat reopened for anadromous fish. A new goal was established and began in 2005. Tributary-specific targets have not been developed but there is a tributary-specific stock assessment in progress. The stock assessment results may provide targets. An ecosystem-based management plan for alosids is under development and will include population and habitat strategies.

Atlantic Coast FMP

Since shad and herring migrate along the Atlantic coast and return to their natal rivers to spawn, coastal management is coordinated through the Atlantic State Marine Fisheries Commission (ASMFC). The ASMFC developed a shad and herring FMP in 1985 and it provides basic guidelines for managing the group from a coastal perspective. The ASMFC FMP was amended in 1999 and provides compliance requirements for all states including monitoring requirements. An important addition to monitoring was the requirement of states to initiate fishery-dependent monitoring programs for river herring and hickory shad. There are three specific compliance requirements described under this amendment: 1) a phase-out of the ocean-intercept fishery of American shad by January 1, 2005; 2) a 10-fish per day creel limit for recreational shad fisherman or more conservative regulations; and 3) a fishing mortality (F) target for in-river fisheries with associated regulations ensuring that the target is met. Four management objectives were also provided, and include: maintaining a fishing mortality below F_{30} for American shad; maintaining a definition of stock restoration and creating a restoration schedule; providing regulations for hickory shad and river herring; and promotion of habitat improvements. In 2000, there was a technical addendum regarding marking of hatchery-reared alosines, and clarification of the requirements for fishery-dependent and fishery-independent monitoring. Maryland, Virginia and the Potomac River Fishery Commission are required to provide ASMFC with an annual report on shad and herring (Appendix 1.1).

Stock status

While it is somewhat difficult to determine historical abundance of alosids in the Chesapeake Bay, recent studies (1983-present) have shown an increasing trend for most species (Sadzinski et al 2005). The restoration of spawning habitat and restocking efforts in combination with the moratoria, appear to have had a positive effect on abundance in the Chesapeake Bay.

An annual survey of alosids is conducted as part of the Maryland DNR Stock Assessment of Selected and Resident Migratory Recreational Finfish Species within the Chesapeake Bay. Both juvenile and mature fish are surveyed; population estimates and fishing mortality estimates are based on these data. Results from the last several years, 2002-2004, indicate an increase in the spawning stock at Conowingo Dam.

American shad

In 2004, the relative abundance of American Shad in the Conowingo Dam tailrace was estimated at 1,005,797 fish. This estimate is based on tag and recapture data. Due to sampling problems, this number is probably an overestimate. Based on population growth models by MDNR biologists, the relative abundance of American shad will peak between 680,000 – 820,000 by 2010 (Sadzinski et al 2005). Projections to 2025 suggest that abundance will not exceed 1.2 million.

Relative abundance has shown an increasing trend (Fig. 1.2). Data indicate that catch per unit effort (CPUE), especially for the recreational catch and release fishery at Conowingo Dam, has increased. Mortality rates calculated in 2004 were unreliable due to a low catch rate. In 2002, MDNR biologists calculated a total mortality for shad in the Bay between 50% and 70%. This mortality rate is mostly attributed to natural mortality because fishing is restricted. The ASMFC fishing mortality guideline is to constrain fishing mortality below F_{30} .

Using the data on multiple spawners and the juvenile finfish index, biologists found a positive correlation between increases in juvenile abundance and increases in adult stocks. This is attributable to restored spawning habitat and restocking efforts. In 2004, only 28% of shad sampled at Conowingo Dam were wild. The data from the Nanticoke has not been analyzed for 2004, but data from the previous year indicate that 84% of fish sampled there were wild. Stocking efforts have focused on the Patuxent, Choptank, and Nanticoke rivers, and Marshyhope Creek.

The reported harvest data from the Atlantic coast has been variable and in 2004 was the lowest since 1983. The decrease in Atlantic coast landings is not an indicator of decreased stock abundance but can be attributed to mandatory reductions in harvest since 2000. Prior to 2000, the CPUEs for coastal landings were decreasing over time. There are several factors that may have influenced these numbers, from market demands to the weather, and consequently, are not an indicator of stock status. Tagging data suggest that

shad caught in the Maryland ocean-intercept fishery were not destined to return to the Chesapeake Bay since they were caught off the coast.

River Herring

There is a small directed fishery for river herring and they are also harvested as bycatch in other fisheries. Pound nets are the primary gear used for commercial harvest in the Chesapeake Bay, but gill nets, haul seines, and fyke nets are also used. In 1931, a record 25 million pounds of river herring were harvested in Maryland, making them the largest catch by quantity for that year. Landings have decreased since then, and current harvest reports for Maryland have been around 70,000 pounds for the last three years.

There has been a decreasing trend in the pound net CPUE of river herring on the Nanticoke over the survey period (1989-2004) and a significant decrease in commercial landings since 1989. For alewife herring on the Nanticoke in 2004, F was 0.60, or a mortality rate close to 45%. For blueback herring F was 0.44, or a rate near 35%. The Nanticoke fishery is directed, so fishing mortality is probably higher there than on the rest of the Bay where river herring are harvested mostly as bycatch. Nanticoke River herring show a decrease in mean length-at-age since 1989. For example, a four-year-old male blueback herring sampled in 1994 would be longer than a four-year-old male blueback herring sampled in 2004. Alosids are important forage fish for large predators such as rockfish and bluefish, and smaller fish could result in higher predation. There is some concern that increased abundance of striped bass have contributed to the decline of river herring in the Bay. The status of the river herring stock in the Chesapeake Bay is unknown but there are indications that the stock is at low abundance. One of the mandates of the ASMFC fishery management plan is to maintain status quo for the river herring species but this recommendation should be more thoroughly evaluated.

Data from the Maryland juvenile survey indicate a stable, although low, abundance of both herring species throughout the survey period (1980-2004). During drought years, the indices dropped as juvenile herring prefer salinities below 2.0 ppt. During those years, most recently 1997-1999 and 2002, herring probably moved upriver to preferred habitat. Virginia's 1980-2001 juvenile indices were similar to Maryland's.

Fisheries Statistics

At one time, American shad were one of the most valuable fisheries in the Chesapeake Bay. In 1896, the Maryland portion of the Bay was the fourth largest producer of American shad in the U.S., with the Susquehanna River and the upper Bay region supporting the largest populations of spawning American shad in Maryland. Commercial landings peaked that year. During the last sustainable fishery in the 1950s and 1960s an average of 4.0 million pounds of shad were harvested. In the late 1970's commercial landings dropped to less than 50,000. American shad were captured in the Chesapeake Bay using a variety of gears including haul seine, pound net, anchor gill net, drift gill net, and stake gill net. Drift gill nets were used off the Atlantic coast of the United States until the recent closure of the ocean-intercept fishery.

There was an intensive recreational fishery for American shad in the Bay and its tributaries during the 1950's through the early 1970's. As stocks declined this fishery became virtually non-existent. Beginning in the mid-1990s, the upper Chesapeake Bay stocks of American shad began to increase, and a catch-and-release fishery rebounded in the Susquehanna River especially below Conowingo Dam. As stocks continue to increase, so does the popularity of the catch-and-release shad fishing.

Hickory shad are often difficult to differentiate from American shad and other herring. This has made it difficult to understand historical trends and the role of hickory shad in the fishery. Because of low abundance, and its close relationship to American shad, the moratorium on shad applies to hickory shad. Currently, there are some restocking efforts underway for hickory shad because they have been successfully reared in the hatchery. However, there is no directed fishery or species-specific research for hickory shad. The reported landing of 11,000 pounds of hickory shad from the Chesapeake in April 2002, illustrates the difficulties associated with the fisheries data. It appears that fisherman mislabeled their catch and actually caught gizzard shad.

Similarly, the only targeted fishery for river herring species is on the Nanticoke River. Since 2002, landings from the Chesapeake have been relatively stable, approximately 70,000 pounds. There were no reported landings from the Atlantic coast in 2002 and 2003. Again, there are difficulties differentiating among the species making landings data inaccurate and unreliable.

Emerging issues

As part of the Chesapeake Bay 2000 Agreement, population targets for American shad were supposed to be determined. Efforts to define when a population is "restored" and to set restoration and/or fishing targets for specific Bay tributaries has been an on-going challenge especially since no fishery dependent data is available to measure abundance. An analysis of historic data completed by Versar in 1995 has been reviewed but not adopted. New tributary-specific targets were drafted and are summarized in Table 1.1 (St. Pierre 2004). These targets will be discussed once the stock assessment is completed.

Restocking efforts in combination with opening access to spawning habitat have made an impact. To date, both hickory shad and American shad restocking efforts are priorities in the restoration of Chesapeake Bay stocks. In 2004, 1.9 million American shad, and 9.9 million hickory shad were restocked in Maryland tributaries of the Bay (Table 1.2). Estimates of how restocking is affecting Bay-wide abundance have not been quantified.

American shad abundance has been estimated from the Conowingo Dam tailrace based on tag and recapture data. Maryland biologists are endeavoring to more accurately quantify what percentage of the total can be attributed to tag loss. This information will contribute to more accurate population estimates. In addition, as part of the Chesapeake Bay 2000 Agreement, the role of water quality and its effects on juvenile habitat is also

being examined. Research is currently being conducted on the relationship between land development within a watershed and juvenile indices. In 2005 a report is expected to be completed on the effect of submerged aquatic vegetation on juvenile shad habitat selection.

The management plan is currently under revision and is one of the plans slated for the development of an ecosystem-based fishery management plan. Ecosystem-based plans will take into consideration the effects of fishing on predator/prey interactions; habitat; the effects of climate and weather effects; uncertainties associated with stock assessments; and human impacts. A draft biological background section is scheduled for completion by December 2005. Current management strategies and actions from the 1989 Alosid FMP and Amendment #1 are summarized in Tables 1.3 and 1.4. Each action is followed by an implementation date and current status.

References

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Mowrer, J. 2005. Resident and migratory juvenile finfish recruitment survey. *In* Stock assessment of selected resident and migratory recreational finfish species within Maryland's Chesapeake Bay. Maryland Department of Natural Resources, Report F-54-R. Annapolis, Maryland.

Piavis, P., R. Sadzinski, and A. Jarzynski. 2001. Stock assessment of selected adult resident and migratory finfish in Maryland's Chesapeake Bay. *In* Stock assessment of selected resident and migratory recreational finfish species within Maryland's Chesapeake Bay. Maryland Department of Natural Resources, Report F-54-R. Annapolis, Maryland.

Sadzinski, R., A. Jarzynski, and P. Piavis. 2005. Stock assessment of selected adult resident and migratory finfish in Maryland's Chesapeake Bay. *In* Stock assessment of selected resident and migratory recreational finfish species within Maryland's Chesapeake Bay. Maryland Department of Natural Resources, Report F-54-R. Annapolis, Maryland.

St. Pierre, R. 2004. American shad population target setting for Chesapeake Bay tributaries. U. S. Fish and Wildlife Service, Harrisburg, Pennsylvania.

Fig. 1. Chesapeake Bay American shad landings, 1888-1994

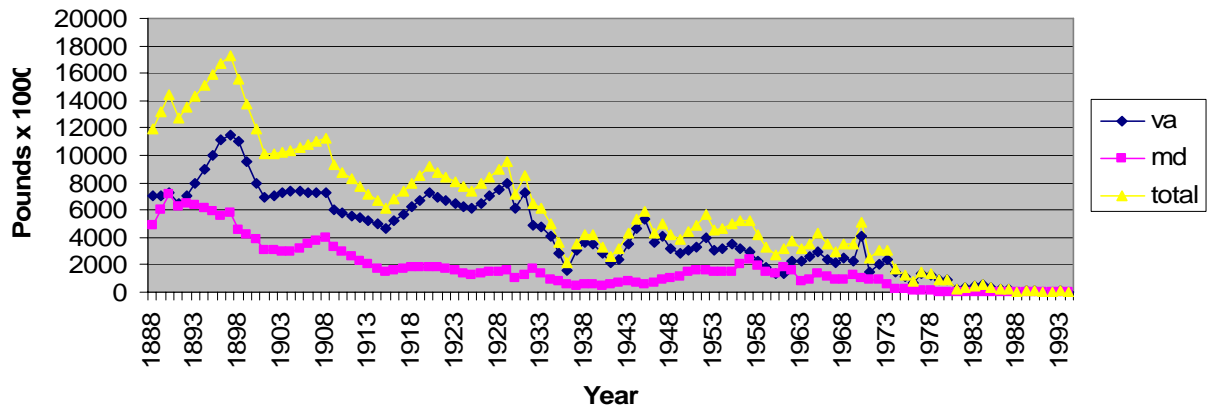


Figure 2. Relative population estimates of American shad in Conowingo Dam tailrace, 1984-2003.

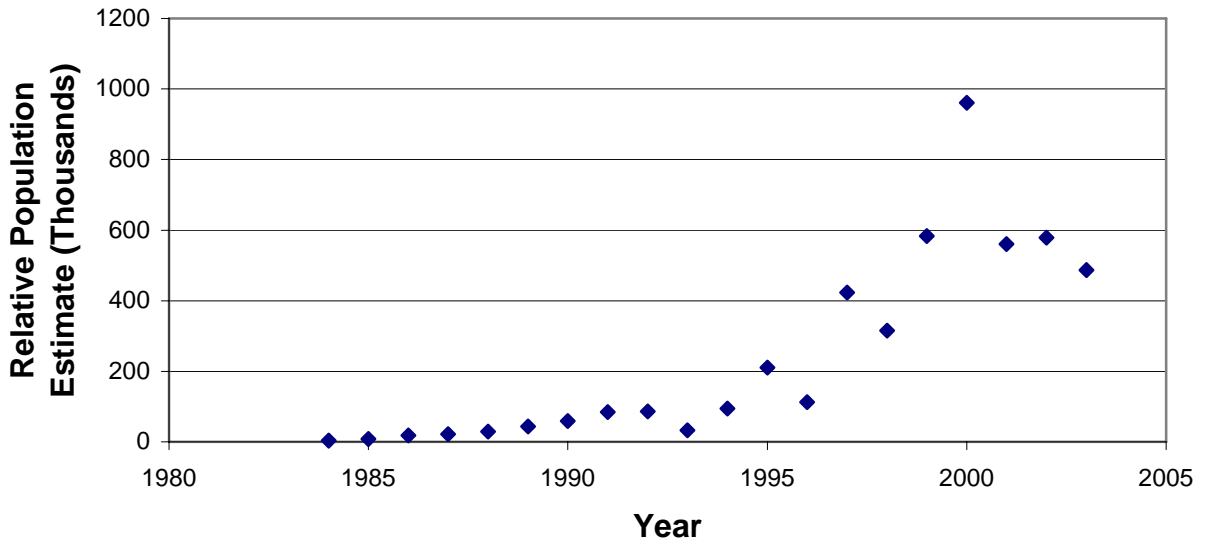


Table 1.1 Comparison of American shad tributary population estimates
(number of fish) derived by Versar (1995) and in this assessment

River/section	Versar	present	Difference ('04 vs '95)
James	570,300	644,600	+74,300
York	1,003,300	1,130,100	+126,800
Rappa'k	182,700	441,600	+258,900
VA Ches Bay	(not given)	519,000	+519,000
Potomac	620,900	698,000	+77,100
Patuxent	15,000	6,500	-8,500
Choptank	139,100	62,900	-76,200
Nanticoke	295,500	158,200	-137,300
Chester	(not given)*	23,300	+23,300
Upper Bay	1,231,300	1,029,600	-201,700
Totals	4,058,100	4,713,800	+655,700

* may be included in upper Bay

Table 1.2. 2004 Maryland Chesapeake Bay Stocking Data

2004 Early Juvenile Stocking Data			
Species	River	Stage	Number
American Shad	Patuxent	Early Juvenile	93,000
American Shad	Choptank	Early Juvenile	125,000
American Shad	Nanticoke	Early Juvenile	60,000
American Shad	Marshyhope	Early Juvenile	33,000
Hickory Shad	Patuxent	Early Juvenile	60,700
Hickory Shad	Marshyhope	Early Juvenile	14,000
Hickory Shad	Choptank	Early Juvenile	42,355
2004 Larval Stocking Data			
Species	River	Stage	Number
American Shad	Patuxent	Larvae	537,000
American Shad	Choptank	Larvae	675,000
American Shad	Marshyhope	Larvae	238,000
American Shad	Nanticoke	Larvae	100,000
Hickory Shad	Patuxent	Larvae	3,425,000
Hickory Shad	Choptank	Larvae	4,090,000
Hickory Shad	Marshyhope	Larvae	500,000
Hickory Shad	Nanticoke	Larvae	1,100,000
Hickory Shad	Patapsco	Larvae	542,000
Hickory Shad	Chester	Larvae	200,000
2004 Coded Wire Tag Stocking Data			
Species	River	Stage	Number
American Shad	Patuxent	Coded Wire Tag	36371
American Shad	Choptank	Coded Wire Tag	28897
Hickory Shad	Marshyhope	Coded Wire Tag	5548

Table 1.3. 1989 Chesapeake Bay Alosid Implementation (10/05)

Problem Area	Action	Date	Comments
1. Declining alosid abundance	1.1.1 Continue shad moratorium in Maryland's portion of the Chesapeake Bay.	Continue	The 2004 population estimate for adult American shad in the Conowingo Dam tailrace exceeded 1,000,000 fish. Upper Bay shad estimates are no longer possible with the loss of a commercial pound net in the Susquehanna Flats. Shad stocks in the upper Bay have been increasing since the moratorium in 1980. VA implemented a moratorium in harvest of American shad from the Bay in 1994. DCFM implemented a moratorium on shad during 1992. PFRC has a moratorium on shad harvest since 1982.
	1.1.2 VA will follow ASMFC recommendation to limit exploitation rate on shad and herring to 25%	1994	ASMFC conducted a stock assessment in 1997. In 1999, amendment #1 to the ASMFC coastal shad plan adopted a strategy to keep Fishing mortality below F_{30} . The next stock assessment update to be peer-reviewed is scheduled for 2005.
	1.2 Control river herring catch, including: by system, regulate areas slated for restoration, gear and/or seasonal restrictions	1990	No restrictions have been implemented for river herring. Commercial harvest has been declining due to low market demands and questionable stock status.
	1.3 Hickory shad fishery will follow the same management actions for shad fishery (see Action 1.1.1)	Continue	MD (1981) and DC (1992) and PFRC will continue moratorium on hickory shad. Recent monitoring results suggest hickory shad are rebuilding in the Bay. Stocking of larval and juvenile hickory shad has occurred on the Patapsco, Patuxent, Choptank, and Nanticoke rivers.
	1.4 Protection will be given to alosids in the Susquehanna as restoration efforts continue	Continue	PA prohibits the harvest of shad
2. Overfishing	2.1 Jurisdictions will participate in the ongoing ASMFC alosid management program, with the goal of providing adequate protection to the component of the coastal stock which returns to Chesapeake Bay to spawn.	Continue	MD, VA, and PFRC participate in the ASMFC shad management board and technical committee
	2.2A Implement a coast shad tagging program to determine which stocks are being exploited in the intercept fishery	1991-1992	Results from the tagging study indicate that the coastal fishery is mixed and highly variable from year to year

Table 1.3. 1989 Chesapeake Bay Alosid Implementation (10/05)

Problem Area	Action	Date	Comments
	2.2B Control the coastal intercept fishery through a combination of gear restrictions, seasonal and area closures, and harvest limits	1993; 2005	ASMFC Amendment #1 requires a closure of the coastal intercept fishery by December 2004. Moratorium on the harvest of shad from coastal waters as of January 1, 2005
	2.2C Continue to monitor and document the territorial seas intercept fishery for American shad	1993; 2004	MD and VA are required to monitor coastal commercial harvest. Completed Dec.2004
	2.3.1 Virginia will control river herring harvest during spawning migrations through gear restrictions and spawning area closures.	1992	The harvest of river herring has declined for a number of reasons.
	2.3.2 MD and VA will monitor river herring bycatch through the MAFMC.	In effect	River herring bycatch is being monitored under the MAFMC Squid, Mackerel and Butterfish FMP.
3. Stock Assessment	3.1 Continue to collect alosid data\	Continue	On-going VIMS, MDNR and DCFM alosid juvenile surveys. The last several years indicate an increase in juvenile alosids.
	a) Collect alosid juvenile data	Continue	Adult shad project on the Nanticoke River was discontinued because lack of tag returns
	b) MD will continue project in upper Bay to estimate adult shad	Continue	Commercial landing data has been improved on a coastwide basis with the establishment of ACCSP. Shad still caught as bycatch.
	c) VA will improve the assessment of shad stocks in territorial waters and improve catch and effort data through mandatory reporting.	Continue	VA & MD provide important data to coastal stock assessment
	d) Continue VMRC stock assessment	Continue	Tagging work completed in 1992. Results indicated coastal catch is mixed and highly variable. Other tagging work has been discussed
	e) VA will initiate ocean intercept tagging program	1991-1992	Mortality rates have been calculated for herring on the Nanticoke River. Exploitation rates for river herring have not been a priority.
	f) MD will examine exploitation rates of herring in selected tributaries and improve landing data	Continue	A map of historic shad and herring spawning areas has been completed. Tributary-specific targets are being considered. The FMPC and ad hoc Fish Passage workgroups have met to discuss how to address the development of targets. CBSAC sponsored a workshop to evaluate different methodologies and recommended a multi-metric approach. A 'white paper' to address the C2K is being drafted and scheduled for completion by December 2004.
	g) VA will implement a survey of alosid spawning grounds and associated biological data		

Table 1.3. 1989 Chesapeake Bay Alosid Implementation (10/05)

Problem Area	Action	Date	Comments
	h) A joint effort will be made to investigate the status of shad in the Potomac	Continue	DCFM has been sampling the upper Potomac for shad and river herring since 1991. A juvenile survey on the Potomac indicates shad are increasing in abundance. The 2003 JI was 2.73 (GM)
4. Habitat loss and degradation	4.1 Implement the Chesapeake Bay Fish Passage Plan A-I) Implement various fish passage projects	Variable	Over 1,400 miles of historic spawning areas have been reopened as of Dec. 2004. A new goal has been developed.
	J) Coordinate resources for restocking efforts	Continue	Between 1986 and 2003, more than 340 million American shad fry and fingerlings were cultured and released in Susquehanna, James, Pamunky, Mattaponi, Potomac & Choptank Rivers.
	K) Establish measures to protect reintroduced fish	1990	Regulations to protect reintroduced herring have not been implemented. Moratorium in effect for shad.
	L) Monitor impact of fish passage projects	Continue	Fishways are monitored on a limited basis as new ladders are constructed. A new 10 year fish passage goal will require all new fish passage projects be monitored to ensure they are passing fish.
	4.2.1 MD and PA will continue to work within SRAFRFC's ongoing programs to ensure downstream passage for juveniles and adults	Continue	SRAFRFC adopted a new Alosid Management and Restoration Plan for the Susquehanna River Basin in 2002
	4.2.2 A) Promote use of Susquehanna brood stock for PA restocking	Continue	PA broodstock are being collected from the Susquehanna River.
	4.2.2 B) VA will expand funding for Pamunky/Mattaponi shad hatcheries	1993	CBP provided limited funds for hatchery work
	4.3 A-E) Technical issues regarding water quality at Conowingo Dam	Continue	Standards were implemented in 1989 and have been monitored ever since. New water quality criteria for living resources have been adopted.
	4.4. Establish new water classification system based on living resources, habitat and water quality		Maps delineating particular habitats of concern have been utilized for developing water quality standards.
	4.5 Promote Bay Agreement water quality commitments	Variable	New commitments were established in the new Chesapeake 2000 Agreement. Of particular importance to alosids will be the assessment of priority migratory species populations and the development of tributary-specific target. STAC sponsored a workshop during 2001 to address targeting efforts. A document to address the targets is under development.

Table 1.4. Amendment #1 to the 1989 Chesapeake Bay Program Alosid Fishery Management Plan
(Amendment adoption: 1998, updated 10/05)

Problem Areas	Action	Date	Comments
1.1 Stock Status	1.1 The Bay jurisdictions will continue the moratorium on American shad in Chesapeake Bay.	1989 Continue	The Bay jurisdiction will reevaluate the criteria for reopening a fishery in Chesapeake Bay during the Alosid FMP revision process. Until new criteria are determined, the moratorium will remain in place for American and hickory shad in Chesapeake Bay. Coastal fishery scheduled for closure December 2004.
1.2 Establish Targets	1.2 The bay jurisdictions will incorporate the shad restoration targets into the revised Alosid FMP	1999 Continue	River specific targets were proposed in 1997, but need to reevaluated. STAC conducted a workshop on alosid targets during 2001. Recommendations from the workshop will be considered. A target-setting white paper is under development
New and Emerging Issues 1) Ecological Role of American Shad in Chesapeake Bay 2) Restoration			
Reduced Spawning Stock	The Bay jurisdictions are continuing stocking efforts to help increase alosid spawning stock biomass. Bay jurisdictions are trapping, transporting and stocking American shad in Chesapeake Bay tributaries.	1986 1996 Continue	Between 1986 and 2000, more than 289 million shad fry and fingerlings were cultured and restoration efforts on the Susquehanna, Pamunky, Mattaponi and Potomac rivers, and several Maryland tributaries. Most recent stocking has occurred in the Choptank River..
Fish Passage	The Bay jurisdictions set 2 fish passage goals; 1) a five year goal to open 731 miles of stream habitat by 1998; 2) a 10-year goal to open 1357 miles of stream habitat by 2003	1993 1998 Continue	Over 1,400 miles of stream habitat was reopened for anadromous fish as of Dec. 2004. A new fish passage goal was adopted in 2005.

FMP= Fishery Management Plan

STAC= Chesapeake Bay Program, Scientific and Technical Advisory Committee